

CLAIMS

What is claimed is:

1 1. An optical apparatus, comprising:

- 2 a) an input port, providing a multi-wavelength optical signal;
- 3 b) a polarization-separating element that decomposes said multi-wavelength
- 4 optical signal into first and second polarization components;
- 5 c) a polarization-rotating element that rotates a polarization of said second
- 6 polarization component by approximately 90-degrees;
- 7 d) a wavelength-disperser that separates said first and second polarization
- 8 components by wavelength into first and second sets of optical beams,
- 9 respectively; and
- 10 e) an array of optical power sensors, positioned to receive said first and second
- 11 sets of optical beams.

1 2. The optical apparatus of claim 1 further comprising an auxiliary polarization-rotating

2 element, such that said first and second sets of optical beams are polarized in two

3 orthogonal directions upon impinging on said array of optical power sensors.

1 3. The optical apparatus of claim 2 wherein said auxiliary polarization-rotating element

2 is disposed between said wavelength-disperser and said array of optical power

3 sensors.

1 4. The optical apparatus of claim 3 wherein said auxiliary polarization-rotating element

2 is configured such that said second set of optical beams undergoes a rotation in

3 polarization of approximately 90-degrees.

1 5. The optical apparatus of claim 3 wherein said auxiliary polarization-rotating element

2 is configured such that said first set of optical beams undergoes a rotation in

3 polarization of approximately 90-degrees.

- 1 6. The optical apparatus of claim 2 wherein said auxiliary polarization-rotating element  
2 comprises an element selected from the group consisting of half-wave plates, Faraday  
3 rotators, and liquid crystal rotators.
- 1 7. The optical apparatus of claim 1 wherein said polarization-separating element  
2 comprises an element selected from the group consisting of polarizing beam splitters  
3 and birefringent beam displacers.  
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- 1 8. The optical apparatus of claim 1 wherein said polarization-rotating element comprises  
2 an element selected from the group consisting of half-wave plates, Faraday rotators,  
3 and liquid crystal rotators.
- 1 9. The optical apparatus of claim 1 wherein said array of optical power sensors  
2 comprises a photodiode array.
- 1 10. The optical apparatus of claim 1 wherein said wavelength-disperser comprises an  
2 element selected from the group consisting of ruled diffraction gratings, holographic  
3 gratings, echelle gratings, curved diffraction gratings, transmission gratings, and  
4 dispersing prisms.
- 1 11. The optical apparatus of claim 1 further comprising a beam-focuser for focusing said  
2 first and second sets of optical beams into corresponding focused spots.
- 1 12. The optical apparatus of claim 11 wherein said beam-focuser comprises at least one  
2 focusing lens.
- 1 13. The optical apparatus of claim 1 wherein said input port comprises a fiber collimator.
- 1 14. An optical apparatus, comprising:  
2 a) an input port, providing a multi-wavelength optical signal;

- 3           b)     a polarization-separating element that decomposes said multi-wavelength  
4                 optical signal into first and second polarization components;  
5           c)     a polarization-rotating element that rotates a polarization of said second  
6                 polarization component by approximately 90-degrees;  
7           d)     a wavelength-disperser that separates said first and second polarization  
8                 components by wavelength into first and second sets of optical beams  
9                 respectively; and  
10          e)     an array of optical power sensors, positioned to receive said first and second  
11                 sets of optical beams;

12           wherein said optical apparatus further comprises a modulation assembly, which is  
13           adapted to modulate said first and second sets of optical beams prior to impinging  
14           onto said array of optical power sensors.

1   15.     The optical apparatus of claim 14 wherein said modulation assembly is adapted to  
2           cause said first and second sets of optical beams to impinge onto said array of optical  
3           power sensors in a time-division-multiplexed sequence.

1   16.     The optical apparatus of claim 15 wherein said modulation assembly comprises first  
2           and second shutter-elements.

1   17.     The optical apparatus of claim 16 wherein said first shutter-element comprises an  
2           element selected from the group consisting of liquid crystal based shutter elements  
3           and MEMS based shutter elements.

1   18.     The optical apparatus of claim 17 wherein said second shutter-element comprises an  
2           element selected from the group consisting of liquid crystal based shutter elements  
3           and MEMS based shutter elements.

1   19.     The optical apparatus of claim 16 further comprising a control unit, in  
2           communication with said first and second shutter-elements.

- 1 20. The optical apparatus of claim 14 wherein said modulation assembly comprises first  
2 and second modulating elements, adapted to cause said first and second sets of optical  
3 beams to carry distinct dither modulation signals upon impinging onto said array of  
4 optical power sensors.
- 1 21. The optical apparatus of claim 20 wherein said first modulating element comprises an  
2 electro-optic intensity modulator.
- 1 22. The optical apparatus of claim 21 wherein said second modulating element comprises  
2 an electro-optic intensity modulator.
- 1 23. The optical apparatus of claim 20 further comprising a control unit, in  
2 communication with said first and second modulating elements.
- 1 24. The optical apparatus of claim 20 further comprising a synchronous detection unit,  
2 configured to detect said dither modulation signals.
- 1 25. The optical apparatus of claim 14 wherein said modulation assembly comprises an  
2 optical beam-chopper.
- 1 26. The optical apparatus of claim 14 wherein said modulation assembly is in optical  
2 communication with said polarization-separating element along with said  
3 polarization-rotating element and said wavelength-disperser, thereby controlling said  
4 first and second polarization components.
- 1 27. The optical apparatus of claim 14 wherein said modulation assembly is in optical  
2 communication with said wavelength-disperser and said array of optical power  
3 sensors, so as to control said first and second sets of optical beams.

- 1 28. The optical apparatus of claim 14 wherein said polarization-separating element  
2 comprises an element selected from the group consisting of polarizing beam splitters  
3 and birefringent beam displacers.
- 1 29. The optical apparatus of claim 14 wherein said polarization-rotating element  
2 comprises an element selected from the group consisting of half-wave plates, Faraday  
3 rotators, and liquid crystal rotators.
- 1 30. The optical apparatus of claim 14 wherein said array of optical power sensors  
2 comprises a photodiode array.
- 1 31. The optical apparatus of claim 14 wherein said wavelength-disperser comprises an  
2 element selected from the group consisting of ruled diffraction gratings, holographic  
3 gratings, echelle gratings, curved diffraction gratings, transmission gratings, and  
4 dispersing prisms.
- 1 32. The optical apparatus of claim 14 wherein said input port comprises a fiber  
2 collimator.
- 1 33. The optical apparatus of claim 14 further comprising a beam-focuser for focusing  
2 said first and second sets of optical beams into corresponding focused spots.
- 1 34. The optical apparatus of claim 33 wherein said beam-focuser comprises at least one  
2 focusing lens.
- 1 35. A method of optical spectral power monitoring using a polarization diversity scheme,  
2 comprising:  
3 a) providing a multi-wavelength optical signal;  
4 b) decomposing said multi-wavelength optical signal into first and second  
5 polarization components;

- 6 c) rotating a polarization of said second polarization component by  
7 approximately 90-degrees;  
8 d) separating said first and second polarization components by wavelength  
9 respectively into first and second sets of optical beams; and  
10 e) impinging said first and second sets of optical beams onto an array of optical  
11 power sensors.

1 36. The method of claim 35 further comprising the step of rotating a polarization of said  
2 second set of optical beams each by approximately 90-degrees, prior to impinging  
3 onto said array of optical power sensors.

1 37. The method of claim 35 further comprising the step of rotating a polarization of said  
2 first set of optical beams each by approximately 90-degrees, prior to impinging onto  
3 said array of optical power sensors.

1 38. The method of claim 35 further comprising the step of modulating said first and  
2 second sets of optical beams, respectively.

1 39. The method of claim 38 wherein said first and second sets of optical beams are  
2 modulated to impinge onto an array of optical power sensors in a time-division-  
3 multiplexed sequence.

1 40. The method of claim 38 wherein said first and second sets of optical beams are  
2 modulated to carry distinct dither modulation signals, upon impinging onto said array  
3 of optical power sensors.

1 41. The method of claim 40 further comprising the step of performing synchronous  
2 detection of said dither modulation signals.

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